The Scientific Method and Controlled Experiments

The Scientific Method:

1. Ask a question and/or make an observation.
2. Develop a hypothesis.
3. Design and Perform an experiment (to test your hypothesis)
4. Analyze the data from your experiment.
5. Make a conclusion (connect your data to your hypothesis)
6. Repeat (if nec.) and communicate results.

Parts of a Controlled Experiment

A controlled experiment is an experiment in which the scientist changes/manipulates only one thing to observe and measure the effects of that one change. Below is an outline of the parts of every controlled experiment. In order to begin developing scientific questions for designing our own controlled experiments, we must fully understand the parts of every controlled experiment.

* **Independent Variable (IV)/Experimental Group (EG)**: The one part of the experiment that is changed/manipulated or given different treatment by the scientist (cause).
* **Dependent Variable (DV)**: The part of an experiment that changes in response to, or affected by, the independent variable. This change is what the scientist observes/measures throughout the experiment (effect).
* **Constants (controlled):** The parts of an experiment that are kept the same for all groups and trials for a fair test.
* **Control Group:** The group that is “normal” or untreated to compare to the experimental group.

Procedure:

1. Identify and state the question.
2. Create a hypothesis.
3. Design & Conduct the experiment.
   1. Identify the Independent (manipulated) Variable:
   2. Identify the Dependent (response) Variable:
   3. Identify the Control Group:
   4. Identify the Experimental Group:
   5. Identify the Controlled Variables (constants)
      1. Collect Data using a data table like the one below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of Airplane** | **Distance (m)**  **(trial 1)** | **Distance (m)**  **(trial 2)** | **Distance (m)**  **(trial 3)** | **Average Distance (m)** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. Analyze the data
   1. Create a bar-graph with…
      1. The independent variable on the X-axis
      2. The dependent variable on the Y-axis
      3. Label each axis and include units where applicable.
      4. Include a title on your graph (Dependent Variable vs. Independent Variable)
2. Write a conclusion.
   1. A conclusion describes/explains the data and states if the hypothesis is supported or rejected by the data. Use the following template for your conclusion.
      1. The hypothesis, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(supported or rejected). The data shows that….